

CLAIMS

What is claimed is:

- 1 1. A heating device for a magnetic recording head, said heating device comprising:
2 an electrical resistor for Joule heating;
3 at least one lead connected to said electrical resistor; and
4 where said recording head includes a metallic structure that is disposed at an air
5 bearing surface (ABS) of said recording head and where said heater is disposed adjacent
6 to said metallic structure, and where said heater is located adjacent to the ABS of said
7 recording head.
- 1 2. The heating device according to claim 1, wherein said heater is electrically
2 isolated from a sensor and an inductive write pole portion of said recording head.
- 1 3. The heating device according to claim 1, wherein said heater has a width in a
2 range of about 1 μm to 10 μm , and a stripe height in a range of about 0.3 μm to about 2
3 μm .
- 1 4. The heating device according to claim 1, wherein said heater has an average
2 operating temperature in a range of about 200°C to about 800 °C.

1 5. The heating device according to claim 1, wherein an electrical resistance of said
2 heater is in a range of about 50 Ohms to about 500 Ohms.

1 6. The heating device according to claim 1, wherein said heater is comprised of one
2 of NiCr, IrRh and NiFe alloys.

1 7. The heating device according to claim 1, wherein said heater is comprised of IrRh
2 (83:17) having a thickness of about 20 nm, a stripe height of about 0.5 μm and a width of
3 about 3 μm .

1 8. A magnetic recording head for recording on a magnetic medium, said recording
2 head comprising:
3 an air bearing surface (ABS) having a leading edge and a trailing edge;
4 a write gap;
5 a metallic structure being disposed at said ABS;
6 an electrical heating device which generates a heat spot on said magnetic medium
7 which is larger than a magnetic track width of said recording head, and heats a portion of
8 said magnetic recording head which is on a leading edge side of said write gap of said
9 magnetic recording head, and where said heater is disposed adjacent to said metallic
10 structure and adjacent to said ABS.

1 9. The magnetic recording head according to claim 8, wherein said heating device is
2 exposed at an air-bearing surface of said recording head and directly heats said magnetic
3 medium.

1 10. The magnetic recording head according to claim 8, further comprising:
2 a heat spreader being disposed in thermal communication with said heating device and
3 located at said ABS.

1 11. A magnetic recording head, comprising:
2 a read sensor,
3 an inductive write head, where said write head has a write gap,
4 an electrical heating device located on a leading edge side of said write gap,
5 where said heater is disposed adjacent to a metallic structure at an air bearing surface
6 (ABS) of the recording head, wherein said heating device generates a heat spot on the
7 ABS which is larger than a magnetic track width.

1 12. The magnetic recording head according to claim 11, wherein said write head
2 includes a first magnetic pole and a second magnetic pole, and wherein said second
3 magnetic pole is located on a trailing edge side of said first magnetic pole.

1 13. The magnetic recording head according to claim 11, wherein at least a portion of
2 said heater is exposed at said ABS.

1 14. The magnetic recording head according to claim 11, where said magnetic
2 recording head comprises a perpendicular recording head.

1 15. The magnetic recording head according to claim 11, where said magnetic
2 recording head comprises a longitudinal recording head.

1 16. The magnetic recording head according to claim 11, wherein said heating device
2 increases a temperature of a heat spreader member of said head, while not substantially
3 increasing a temperature of said sensor on said head, such that the increased temperature
4 on said sensor decreases the signal by no more than 5%.

1 17. The magnetic recording head according to claim 11, wherein said magnetic sensor
2 comprises a magneto-resistive element.

1 18. The magnetic recording head according to claim 11, further comprising:
2 at least one thermally disruptive layer between said heating device and said
3 magnetic sensor which disrupts thermal conduction from said heating device to said
4 magnetic sensor.

1 19. The magnetic recording head according to claim 11, wherein a distance between
2 said heating device and said magnetic sensor is greater than 2 μm .

1 20. The magnetic recording head according to claim 11, wherein said magnetic sensor
2 is heated no more than 10°C during an operation of said heater.

1 21. The magnetic recording head according to claim 18, wherein said at least one
2 thermally disruptive layer comprises a heat sink.

1 22. The magnetic recording head according to claim 18, wherein said at least one
2 thermally disruptive layer is comprised of plated copper.

1 23. A hard disk drive including a magnetic recording head comprising:
2 a spindle and motor for rotating a magnetic disk; and
3 an arm comprising a suspension and the magnetic recording head, for selectively
4 locating said magnetic recording head over said magnetic disk, said recording head
5 including:
6 a read sensor,
7 an inductive write head, where said write head has a write gap,
8 an electrical heating device located on a leading edge side of said write gap,
9 where said heater is disposed adjacent to a metallic structure at an air bearing surface
10 (ABS) of the recording head, wherein said heating device generates a heat spot on the
11 ABS which is larger than a magnetic track width.

1 24. The hard disk drive according to claim 18, further comprising:

2 amplifiers for read and write data processing in said disk drive;
3 a controller for controlling an operation of said disk drive; and
4 channel electronics for data communication in said disk drive.

1 25. A thermally-assisted recording method, comprising:
2 heating a spot on an air bearing surface of a magnetic recording head utilizing an
3 electrically resistive heater, where said spot is located on a leading edge side of a write
4 gap of said magnetic recording head;
5 generating a heat spot on a recording medium which is larger than a magnetic
6 track width.

1 26. The thermally-assisted recording method according to claim 25, wherein said
2 heating comprises using said electrically resistive heater to heat at least one magnetic
3 pole layer in said magnetic recording head, and a portion of an air-bearing surface of said
4 magnetic recording head.